

VI.—*The Geographical Relations of the New-Zealand Fauna.*
By Captain F. W. HUTTON, C.M.Z.S.*

I KNOW of no part of the world that presents such a promising field to the student of nature as New Zealand. Although small in size, it contains a fauna and flora so peculiar that several naturalists consider it a separate biological province apart from the rest of the world. Isolated from any large continental area longer probably than any other portion of the earth, it contains the remnant of the population of a continent that existed before the Mammalia had overspread the world; and to that has at various times been added, principally from Australia, a colonist population which culminated not many hundreds of years ago in the advent of man. New Zealand, therefore, presents us with what I may call the elements of a continental fauna, or a continental fauna in its simplest state, and consequently in that state which is most advantageous for studying the mutual relations of the animals composing it.

Both Mr. Darwin and Mr. Wallace call New Zealand an "oceanic island" from a zoological point of view, owing to the absence of terrestrial mammals and the meagreness of its fauna and flora; that is to say, they consider it an island that has never formed part of a continental area since its last emergence from the sea. But I think that the Struthious birds have certainly as much weight in determining this point as terrestrial mammals, for they have no superior means of dispersion; and New Zealand also possesses a frog, which is one of the great characteristics of a continental fauna. From a geological point of view, I do not see how any land, except volcanic and coral islands, could have originated except as part of a large continental upheaval. I think, therefore, that the New-Zealand fauna may be correctly called the remnants of a continental fauna, and that a close study of it will throw great light on many of the most important, but at the same time most obscure, problems in zoology. It will, however, be long before this can be accomplished. The describing and naming of the different animals, which is the foundation upon which all other researches must rest, is as yet far from being completed; the determination of what species are the original inhabitants, or the descendants of the original inhabitants, of the former continent has hardly been attempted; but all this must be settled before any sound deductions can be drawn as to the reasons of extinction, variation, or permanency of type of the animals.

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It is to this latter point that I wish to draw attention—not that I am in possession of information sufficient to prove any one perhaps of the points that I shall raise, but because I think that sufficient is known to establish with great probability the main features in the zoological history of these islands; and this sketch which I now presume to offer will, I hope, induce others to examine the subject more in detail, and will give a systematic direction to their observations. I propose to take first the zoological evidence—to point out the principal facts that have to be accounted for and the deductions that they lead to; I will then rapidly glance at the geological and palæontological evidence; and, finally, I will draw up from the whole the hypothesis that appears best able to account for all the phenomena.

MAMMALIA.

Of our two bats, one (*Scotophilus tuberculatus*), although not found elsewhere, is closely allied to those of Australia, while the other (*Mystacina velutina*) forms the only species of a genus peculiar to New Zealand, but related to bats living in South America.

Two species of seal frequent our shores—the sea-leopard (*Stenorhynchus leptonyx*), which is also found on ice-floes in the antarctic seas, and occasionally extends to Australia, and the fur-seal (*Arctocephalus cinereus*), which is supposed to occur also on the southern coasts of Australia, and is closely related to, if not identical with, a species found at the Falkland Islands, Cape Horn, South Shetland, and South Georgia. In the Otago Museum there is also a skull that appears to belong to the sea-elephant (*Moringa proboscidea*). Mr. Purdie informed me that it was picked up a long way inland.

Of the Cetacea, some twelve or thirteen species are known, belonging to the six different families into which the marine members of this order have been divided; and it is remarkable that two thirds of them are endemic—that is, not found anywhere else. Our two or three species of whalebone-whale have, up to the present, been found nowhere else. The sperm-whale of our northern coasts is probably the same species as that found in Australia and the South Pacific (*Catodon australis*); it is certainly distinct from the northern sperm-whale (*C. macrocephalus*), as the lower jaw is much narrower*.

Our ziphioid whales, of which we have three or four species, are all endemic; and two of them (*Berardius Arnuxii* and *Me-*

* A lower jaw of the New-Zealand sperm-whale in the Auckland Museum is 17 ft. 7 in. in length and only 2 ft. 2 in. in width at the condyles; there are twenty-three teeth on each side, four of which are rudimentary only; the length of the largest tooth is 7·4 in.

soplodon Hectori) belong to genera not found elsewhere. None, however, of our Delphiniidæ are confined to New Zealand. *Delphinus novæ-zealandiæ* inhabits the antarctic seas and perhaps Tasmania; *Lagenorhynchus clanculus* is found throughout the Pacific Ocean, but not in Australia; and *Orca capensis*, a lower jaw of which is in the Auckland Museum, ranges from the Cape of Good Hope through the Southern Ocean to Chili, and is also found in the North Pacific and Tasmania. The blackfish (*Globiocephalus macrorhynchus*) is found in the South Pacific and Japan, but not in Australia. Our Cetacea, therefore, contrary to what might have been expected, show a nearer relation to the Pacific and Antarctic oceans than they do to Australia; and it is remarkable that no species of porpoise has as yet been described as found in New Zealand, although two inhabit Tasmania.

The absence of terrestrial Mammalia is one of the chief points of interest in New-Zealand zoology, as it proves that there has been no land communication between this country and Australia since the latter was inhabited by Marsupials; for I consider that the so-called Maori rat and native dog were both introduced by human agency*.

Sir George Grey informs me that he sent to the British Museum some grey "Maori rats" which had been caught in the interior of the South Island in 1847 by Mr. Torlesse, and that Dr. Gray had said that they were identical with a rat found in Polynesia, by which he must have meant the black rat (*Mus rattus*); for none of the islands in the Pacific possesses an indigenous rat. Dr. Buller also collected a considerable amount of evidence to show that the "kiore-maori" was identical with a rat (now in the Colonial Museum) which he described (Trans. N.-Z. Inst. iii. p. 1) under the name of *Mus novæ-zealandiæ*, but which is certainly *Mus rattus*. Mr. Colenso says (Proc. R. Soc. of Van Diemen's Land, 1851, p. 301), in a letter to R. Gunn, Esq., dated 4th September, 1850, that after considerable trouble he had procured two specimens of the native rat, which he describes as "smaller than our English black rat (*M. rattus*), and not unlike it." Against this we have the statement of Dr. Dieffenbach, who says ('New Zealand,' ii. p. 185) that it was the English and not the Norway rat that killed off the "kiore-maori." This, I think, must be a mistake, as all the Maoris attri-

* Captain Cook remarks, in his first voyage, that rats were "so scarce that many of us never saw them" (Hawkesworth's 'Coll. of Voy.' iii. p. 34). He makes no mention of their ever being used for food; and I am not aware of any remains of rats having been as yet found in Maori cooking-places.

bute the destruction of the edible rat to the brown rat, and it could only have been from Maoris that Dr. Dieffenbach got his information. Mr. Murray also states (Distr. of Mammals, p. 277) that the Norway rat (*M. decumanus*) was not introduced into New Zealand in 1843; but he gives no evidence of the truth of this statement; and it is unquestionably erroneous *. The whole of the reliable evidence that we have, therefore, goes to prove that the Maori rat was no other than *M. rattus*.

The so-called "native dog" has been determined by Dr. Gray to be *Canis familiaris* (Proc. Zool. Soc. 1868, p. 508), and not the Australian species or variety called *Canis dingo*, which is the strongest possible evidence of its being merely an escaped domestic breed; indeed I am not aware that any naturalist believes in an indigenous native dog, except Dr. Haast, who has argued (Trans. N. Z. Inst. iv. p. 88) that a wild dog existed in New Zealand before the domesticated one, because in certain old Maori cooking-places he has found remains of the dog but no gnawed bones; while in others, which he considers of later date, he finds gnawed bones †. But I am not aware that he has any proof of the existence of a dog in New Zealand before the arrival of man; the difference of date of these cooking-places for which Dr. Haast contends is denied by many observers, and his argument derived from the presence or absence of ground stone implements has, I think, been successfully controverted. I can therefore attach no weight to the absence of gnawed bones. On the other hand, there is the fact that no indigenous dog or rat has ever been found on an island that was not inhabited by other Mammalia; and when we remember that Marsupials came into existence long before rats and dogs, it is difficult to see how the latter could possibly get to any country without the former coming also. It is evident that neither Banks, nor Solander, nor the Forsters considered the dog and rat that they found in

* Since reading this paper Mr. Nichol has informed me that the brown rat was common in Nelson when he first arrived in the early part of 1842, and that he never saw any other kind there except a single specimen of a very large and slightly striped variety.

† The skulls of dogs found in old Maori cooking-places prove undoubtedly that *Canis familiaris* existed in New Zealand long before Europeans came here. Captain Cook says (21st October, 1769) that the dogs were "small and ugly;" and Mr. Anderson ('Cook's Third Voyage,' i. p. 153) calls it a "sort of fox-dog." Captain Cook also says in his first voyage that the dog was used for no other purpose than to eat. The fact that the inhabitants of the Friendly Islands have the same name (*kuri*) for the dog as the New-Zealanders is strong evidence that the latter brought it with them; for if not, they would have lost the name, as they have done that of the fowl.

New Zealand a new species, or they would certainly have mentioned it; neither did Lesson in 1827, nor Quoy and Gaimard in 1831. Dr. Dieffenbach in 1842 was the first to state that a frugivorous rat, distinct from *M. rattus*, existed in New Zealand, he probably not being aware that *M. rattus* is entirely frugivorous. I am therefore of opinion that both the rat and the dog were brought by human agency; and it is worth remarking that the Maori traditions relate that they brought both with them (Travers, Trans. N. Z. Inst. iv. p. 58). The specimen of *Mus Gouldi* in the Auckland Museum (see Trans. N. Z. Inst. iii. p. 3) was caught, I believe, at the Thames in January 1853; and as a mission-station had been established there some years previously, this specimen was no doubt brought over from Australia in their vessel.

The animal seen at Dusky Bay by some of Captain Cook's sailors (Second Voyage, i. p. 98) was probably a dog, as none on board had at that time seen a dog in New Zealand.

The evidence of a kind of otter inhabiting the South Island rests upon some footprints seen by Dr. Haast, and mentioned by him in his first presidential address to the Canterbury Philosophical Society (Nat. Hist. Rev. 1864, p. 30). In the same address he also mentions having seen tracks in great numbers of a small jumping mammal in the river-bed of the Hopkins; but as no further evidence of the existence of these creatures has been adduced, although eight or nine years have since elapsed, it is impossible for me to take any further notice of them in this paper.

BIRDS.

The first point that claims our attention here is the great development of the Struthious birds. This division can be subdivided into two families—one (*Apterygidæ*) containing only the kiwis, and the other (*Struthionidæ*) including all other living forms as well as the extinct moas. The kiwis in the structure of the egg-shell have an affinity with the Carinate division of birds. Their short legs, and the presence of a hind toe elevated above the level of the others, show an approach to the Gallinaceous order; while their long bill, with its slightly swollen tip, resembles in some measure that of the Scolopacidæ, which have also the same habit as the kiwi of feeling about on the ground with their bill. *Gallinago pusilla*, moreover, lives in holes, and only comes out at night (Travers, see Art. xxii.).

Thus the Apterygidæ have a more generalized structure than the other Struthious birds; they therefore belong to an older type, and cannot with any degree of correctness be said

to represent the extinct race of moas. The relations between the second family, or the Struthionies proper, are very complicated; but *Dinornis*, which alone concerns us here, appears to be intermediate between the rheas of South America and the emus and cassowaries of Australia and the adjacent islands. It approaches the rhea in the structure of its egg-shell, and in having only three pairs of sternal ribs; while the emu, the cassowary, and also the kiwi have four, and the ostrich five pairs. In the structure of its feathers and in the shape of its pelvis and skull the moa approaches the emu. The Struthious birds exhibit a type of structure intermediate in many respects between the Carinate birds and the extinct Dinosaurians; and this leads naturalists to suppose that they are but the remnant of a race that once spread over the whole earth. About twelve species are known outside New Zealand; while here, besides our four species of *Apteryx*, Professor Owen has determined fourteen species of *Dinornis*, three of *Aptornis*, and one of *Cnemidornis*, thus making a total of twenty-two species of Struthious birds, belonging to four different genera, living in New Zealand only a few hundred years ago—that is to say, nearly twice as many as are found in all other parts of the world put together.

Probably, however, some of Professor Owen's species of *Dinornis* are but the young of others; and it seems to me very doubtful whether *Aptornis* and *Cnemidornis* should be regarded as struthious birds at all. It is evident that these two genera are closely related; and if the wing-bones placed upon *Cnemidornis calcitrans* really belong to the legs of the same bird, we must suppose that the sternum had a keel sufficiently developed to support muscles of a size proportionate to the wings; for although we can understand how the kakapo (*Stringops*), belonging to an order of deeply keeled birds, may have lost, by disuse of the pectoral muscles, the keel on its sternum, we cannot possibly explain how a struthious bird could have had large wing-bones developed unless it had also sufficiently powerful muscles to use them. I also observe that *Aptornis defossor* now wears a skull similar to that of the late *Dinornis casuarinus*, which skull Mr. W. K. Parker says undoubtedly belonged originally to a *Notornis*. But, omitting these two genera and making a due allowance for doubtful species of *Dinornis*, the great number of species living on so small an island is very remarkable when contrasted with other parts of the world. The continent of Africa, including Arabia, contains but one (or, according to some naturalists, two) species of ostrich. South America, from Patagonia to Peru, has but three species of rhea, each inhabiting a separate district.

Australia possesses two species of emu, one on the eastern and the other on the western side, and one species of cassowary on the northern, while five other species of cassowary inhabit other detached islands, from New Britain and New Guinea to the Molucca Islands. I believe that outside of New Zealand no two species of struthious birds are found living in the same district, while here we have now four species of kiwi, and not long ago had at least half a dozen species of moa as well. How can this be accounted for? The solution is readily found by examining the distribution of the cassowaries. Here we have six species inhabiting six isolated localities. If now this region of the earth were to be elevated, these six species might mingle; and if it were subsequently to sink again, all six species would undoubtedly be driven to the higher lands, and we should have in this supposed island a representation of New Zealand inhabited by six species of Struthious birds.

In order, therefore, to account for the numerous species of *Dinornis*, we must suppose an ancient continent inhabited by one or two species to sink and the birds to take refuge on the different mountain-ranges left as islands above the water. We must suppose that they remained thus isolated from one another for a sufficiently long period to allow of specific changes being brought about, that then by an elevation of the land they once more mingled together, and that, on subsidence again taking place, New Zealand, as the central mountain-chain, formed a harbour of refuge for them all.

Whether this isolation of species points to some cause as yet unrecognized, by which in the struggle for life no two species of struthious bird can live in close proximity, I will not venture to give an opinion; but it is a fair subject for inquiry, and one on which the careful study of the relative ages of moa-bones might throw considerable light, and enable us perhaps to understand the great mortality that must have taken place amongst the moas when confined to these small islands long before man set his foot here.

The distribution, therefore, of the Struthious birds in the southern hemisphere points to a large antarctic continent stretching from Australia through New Zealand to South America, and perhaps on to South Africa. This continent must have sunk; and Australia, New Zealand, South America, and South Africa must have remained isolated from one another long enough to allow of the great differences observable between the birds of each country being brought about. Subsequently New Zealand must have formed part of a smaller continent, not connected either with Australia or South America, over which the moa roamed. This must have been fol-

lowed by a long insular period ending in another continent still disconnected from Australia and South America, which continent again sank and New Zealand assumed somewhat of its present form.

Passing now to the Carinate division of birds, the first thing that strikes us is the fragmentary nature of this part of our avifauna (if we exclude the Grallæ and web-footed birds), thus strongly contrasting with the Struthious division.

Of the first six orders we possess (excluding the Chatham and Auckland Islands) forty-five species, thirty of which are endemic. These have been referred to thirty-one genera, ten of which are found nowhere else; and these thirty-one genera belong to twenty families, one of which (*Stringopidæ*) is peculiar to New Zealand. Two families only, the honey-eaters (*Meliphagidæ*) and the starlings (*Sturnidæ*), contain more than two genera. The first shows affinity to Australia; but it must be remarked that out of the four species of this family, belonging to four different genera, one genus only (*Zosterops*) is found in Australia, and the little bird (the "white-eye") that belongs to this genus is known to be quite a recent arrival in this country. The *Sturnidæ*, on the other hand, show an affinity with Polynesia; for one species only (*Calornis metallicus*) of this family is found in the north of Australia and in New Guinea. It should, however, be noticed that three other species are found in the latter island. In this family also our three species belong to three different genera, two of which (*Creadion* and *Heteralocha*) are found nowhere else, while the other (*Aplonis*) is very characteristic of Polynesia; and *Aplonis caledonicus*, which is said to have been found in New Zealand, occurs also in Norfolk Island and New Caledonia.

It is remarkable that our two owls should both be peculiar to New Zealand, and that one of them (*Sceloglaux albifacies*) should belong to a genus not found elsewhere; for the owls are usually widely spread birds, more so, indeed, than the hawks. It is also worthy of notice that *Strix delicatula*, which extends its range over most of the Pacific islands and Australia, should be absent from New Zealand.

Our parrots present several points of interest. The kakapo (*Stringops habroptilus*) is found nowhere else; the genus *Nestor* extends only to Norfolk Island, while our perroquets, although belonging to a genus (*Platycercus*) equally plentiful both in Australia and Polynesia, show a greater affinity to the latter, one species (*P. novæ-zealandiæ*) ranging not only to Norfolk Island, but also to New Caledonia. It is remarkable that we have no representatives of the cockatoos and grass-perroquets so common in Australia and Tasmania; for our own

climate is quite suitable for them. The absence of Polynesian forms is not so remarkable, as they belong chiefly to more tropical genera, and the members of the genus *Coriphilus* are said to live only on bananas.

That we should have two cuckoos which migrate regularly to other countries each more than a thousand miles distant, is a fact that deserves special attention; for I know of no parallel case in any other part of the world, the distance across the Mediterranean being less than half that travelled over by our summer visitants. The phenomenon of a bird at a certain season of the year flying out to sea to an island more than a thousand miles distant is remarkable enough, but is rendered still more so in the case of the little shining cuckoo (*Chrysococcyx lucidus*, which is supposed to come from Australia) by there being no apparent necessity for it; for this bird migrates east and west, and not from a warmer to a colder climate, and two other closely allied species which inhabit Australia never leave the country at all. Even in the case of the long-tailed cuckoo (*Eudynamis taitiensis*), which comes to us from the equable climate of the South-Sea Islands, we cannot suppose that its migrations are caused either by alteration of temperature or by want of food; and the question forces itself upon us, How could this habit have arisen? The only reasonable hypothesis is, I think, that at one time the different lands to and from which these birds fly were connected, or nearly so, that the distance between them gradually increased, and that the habit so common amongst birds of resorting each year to the same place to breed was not lost, but gradually merged into a regular migration. From this point of view, the arrival of the shining cuckoo indicates a connexion with Australia or perhaps New Guinea, while that of the long-tailed cuckoo indicates one with Polynesia; and it must be noticed that, while the latter bird is identical with specimens from Polynesia, the former shows such differences in the colouring of the tail-feathers from the birds inhabiting Australia, that it is considered by many naturalists to be a distinct species. Another remarkable fact that has been quite lately brought to light is that the shining cuckoo of the Chatham Islands is not the same variety as that visiting New Zealand, but is almost, if not quite, identical with an Australian species (*C. plagosus*). This curious fact proves how strong must be the force of habit; for these birds in their migration to and from the Chatham Islands must pass over, or at least in sight of, New Zealand; but instead of stopping after a journey of 1400 miles, they continue on for 450 miles more, until they reach the little island that they have selected as their home.

A more difficult fact to account for is the presence of different species of grass-bird (*Sphenæacus*) in both Australia and New Zealand; for this bird has such feeble powers of flight that it could not cross a river, and must almost of necessity have travelled by land. It must, however, be noticed that this genus extends through the Indian archipelago into India, and I have not been able yet to compare our grass-birds with those of Australia and the archipelago, so that I am not able to say what amount of difference there is between them. The genus *Keropia* has most affinity with South-American birds, while *Graucalus melanops*, which is closely related to our *G. concinnus*, is said to extend from Australia into New Guinea.

In the order Grallæ, or Waders, we come to birds more widely spread than any others, some indeed being almost cosmopolitan: but even amongst these the isolated character of our fauna is still marked; for out of twenty-eight species belonging to seventeen genera eight species and two genera are found nowhere else. The most noticeable feature in this order is the existence of a curious genus of rails (*Ocydromus*) quite unable to fly. Of this genus we possess four species, one in the North and three in the South Island, while a fifth species is found in Lord-Howe Island, and a sixth in New Caledonia. *Notornis*, although somewhat like the pukeko (*Porphyrio melanotus*) in the bill, has the feeble wings, thick legs, and short toes of *Tribonyx Mortierii* of Tasmania and Australia. Of our other rails, two (*Rallus pectoralis* and *Ocydromus tabuensis*) are spread over Australia and Polynesia, while another (*O. affinis*), although not found elsewhere, is closely related to a species from Australia (*O. palustris*). In the godwit (*Limosa uropygialis*) we have another migratory bird that probably comes from Polynesia; but as it is also found in Australia, we cannot feel any certainty about it. New Zealand also displays the peculiarity of being the only country in the world inhabited by two species of stilt-plover (*Himantopus*), one of which (*H. novæ-zelandiæ*) is found nowhere else. This is probably owing to the length of time that New Zealand has been isolated, and to its having had during the whole of the period a stilt-plover on it, which gradually changed until it attained that remarkable jet-black plumage which is so different from that of any other species; while the later colonist from Australia (*H. leucocephalus*) displays the colour usual to the genus. This view is rendered the more probable by the fact that the young of the black stilt-plover have the same pied plumage that is exhibited by the adults of those species from one of which I suppose it to have been derived.

In the crookbill (*Anarhynchus frontalis*) we have another

curious anomaly which as yet has received no explanation; and it must also be noticed that Cape Horn, the Cape of Good Hope, Australia, and New Zealand possess each a black oystercatcher (*Hematopus*) which are considered specifically distinct.

Among the herons the only very remarkable fact is the occurrence of the little bittern (*Ardea pusilla*), a bird found only in Australia and Natal. Our snipe (*Gallinago pusilla*) very much resembles in plumage *G. Stricklandi* from Tierra del Fuego, but it has a shorter bill.

Among the web-footed birds the first thing that claims our attention is the oceanic family of the petrels (*Procellariidae*), for although by no means peculiar to New Zealand*, the great number of species in the southern oceans in comparison with the small number in the northern is very noticeable. The northern and tropical species have all closely allied forms in the southern hemisphere, while many of the southern petrels (such as *Ossifraga*, *Halodroma*, *Majaqueus*, *Pterodroma*, *Daption*, and *Prion*) have no representatives in the northern seas. This leads to the inference that the northern species have been derived from stray southern birds, and that the southern hemisphere has been the centre from which most oceanic birds have spread, while land birds, on the contrary, have spread chiefly from northern areas; and this leads to the further inference that the southern hemisphere has been for many ages more oceanic in character than the northern. The next most remarkable point is the great development of the cormorants, New Zealand possessing nine species, four of which are found nowhere else. No other country in the world possesses so many; and the phenomenon can only, I think, be accounted for in the same way as the numerous species of moa—that is, by the former existence of several small islands which have since been elevated to form the present New Zealand. The wide dispersion, however, of two of our cormorants is rather against this view, one (*Graculus carunculatus*) being found at the Crozet Islands and at Cape Horn, and the other (*G. carbo*) in Australia, China, and Europe. I must, however, remark that the identity of the first has not yet been perfectly established, and that the second, although very closely resembling specimens from Europe, shows at the same time some difference. It may also be useful to remark here that our gannet (*Dysporus serrator*), although a far better-flying bird than the cormorants, is not found at the Chatham Islands; and Dr. Finsch informs me that it is undoubtedly different from

* *Procellaria Parkinsoni* is peculiar to New Zealand.

the species (*D. capensis*) that occurs at the Cape of Good Hope. The occurrence of *G. brevirostris* and *G. melanoleucus* in New Zealand presents a parallel case to the two species of stilt-plover, with, however, this difference—that, judging from the colours of the young bird, it is probable that *G. melanoleucus* has been derived from *G. brevirostris* owing to its having been isolated in Australia, and that its descendants have migrated back again to New Zealand.

Of the gulls we possess a species (*Larus pomare*) which is found nowhere else—a peculiarity of which few countries can boast, but which can perhaps be accounted for by the fact that this gull only frequents freshwater lakes and seldom comes down to the sea. Our other gulls are widely spread; but it is a most remarkable fact, which at present appears to me to be quite inexplicable, that neither gulls nor cormorants occur in any of the Polynesian islands.

Of ducks we possess nine species, four, or perhaps five, of which are endemic—one, the blue duck (*Hymenolemus malacorhynchus*), belonging to a curious genus found only in New Zealand, but related to a genus (*Malacorhynchus*) in Australia. The others are all found in Australia—one (*Pterocyanca gibberifrons*) ranging through New Caledonia and the Indian archipelago, and another, the common grey duck (*Anas superciliosa*), spreading over Polynesia as far north as the Sandwich Islands. The most remarkable circumstance connected with our ducks is the presence of a species of *Fuligula*, a genus found neither in Australia nor Africa, but belonging properly to the northern parts of America, Europe, and Asia, although one species is found in South America. The occurrence, however, of a northern species (*F. cristata*) in the Pelew Islands points out to us perhaps the route along which the ancestors of our species travelled.

The Chatham Islands possess thirty-two species of birds (omitting the gulls, penguins, and petrels), of which six are found nowhere else. All the others are found in New Zealand, except the shining cuckoo (*C. plagosus*), which, as already stated, migrates to and from Australia. No genus, however, is peculiar to these islands, except perhaps a rail (*Rallus? modestus*) which is evidently incapable of flight, and which will probably have to be placed in a genus by itself. This curious form must not, however, be regarded as a change produced by long isolation, but rather as an old form preserved from destruction by isolation. The most noticeable circumstance in the Chatham-Island fauna is the absence of Raptores, with the exception of an occasional visit from the harrier (*Circus Gouldi*), which does not, however, appear

to inhabit the islands, or at any rate is exceedingly rare there.

The Auckland Islands possess twelve birds, three or four of which are endemic, the remainder all belonging to New Zealand. The most remarkable facts are the occurrence of a species of merganser (*Mergus australis*), a genus found only in high northern latitudes, and of a duck (*Nesonetta aucklandica*) with very short wings, belonging to a genus found nowhere else.

On Norfolk Island we know of twenty-six birds. Of these, two (*Aplonis caledonicus* and *Platyercus nove-zelandiae*) are found in New Zealand and New Caledonia, five others are common to New Zealand and Australia, a species of *Nestor* (*N. productus*) used to inhabit Philip Island close by, and the remainder show an affinity to Australia.

Lord-Howe Island possesses only six land birds, two of which (*Charadrius bicinctus* and *Ocydromus sylvestris*) show a connexion with New Zealand, while the rest show an affinity to Australia.

A review of the facts disclosed by a study of the distribution of the Carinate birds shows that, although the affinity is greater with Australia than with any other place, there is yet a decided leaning towards Polynesia; and when we remember that a large portion of Australia lies in the same latitude as New Zealand, while the whole of Polynesia is far away to the north, I think the difference is not so great as might have been expected*. The distribution of the genus *Ocydromus* proves that land communication must once have existed between New Zealand, Lord-Howe Island, and New Caledonia; but the absence of cockatoos, grass-perroquets, pigeons, night-jars, and finches indicates that this connexion did not extend to Australia. With the exception of *Sphenæacus*, which has very feeble powers of flight, all our Australian birds could have crossed over a strait of considerable width. The phenomena of the perroquets, starlings, and long-tailed cuckoo of Polynesia being associated in New Zealand with the honey-eaters, grass-bird, and gold cuckoo of Australia, indicate that New Zealand was connected with a tract of land intermediate to both, but perhaps not connected with either; at the same time the absence of the more tropical Polynesian birds is no evidence that this tract of land did not extend into Polynesia; and in *Zosterops lateralis* and *Dendrocygna Eytoni*, both of which have appeared since Europeans came into the colony,

* The distribution of the Megapodidæ shows that Polynesia, Australia, the Indian archipelago as far as the Strait of Lombok, North-west Borneo, and the Philippine Islands were united before the spread of the mammals,

we have positive evidence that our islands can even now be colonized from Australia by many kinds of birds, although 1400 miles distant. It would also appear that this transfer of birds to New Zealand took place sufficiently long ago to allow of changes of generic value having taken place, while the Chatham and Auckland Islands have been isolated from New Zealand for a time sufficient only for changes of specific value.

REPTILIA.

The Reptiles of New Zealand are not numerous. We possess about eight species of lizards, four of which belong to widely spread genera of the family Scincidæ; but the species are all endemic. Three others belong to the Geckotidæ, and form a genus (*Naultinus*) which is found nowhere else. Of these, one (*N. pacificus*) is said to be found in some of the Pacific islands; but the other two are peculiar to New Zealand. Our eighth species, the curious tuatara (*Sphenodon punctatum*), which is now found only on a few rocky islets in the Bay of Plenty and near Tory Channel in Cook's Strait, is placed by Dr. Günther in a separate order from all other lizards on account of the affinity that it shows to the crocodiles. This remarkable form has no copulatory organs, and has uncinatè processes on its ribs like birds. It has also nearly twice as many abdominal as true ribs, which protect the abdomen when being dragged along the ground, for, as in the crocodile, the hind legs are too weak to support the hinder parts of the body; Dr. Günther also suggests that they may use these ribs for locomotion as snakes do. It is also remarkable that this animal, which lives in holes and only comes out during warm weather, should have the dorsal crest that is so characteristic of tree-lizards.

I omit all reference to *Norbea? isolata*, supposed to come from White Island in the Bay of Plenty, because its true locality is not sufficiently well established; if, however, another specimen should be obtained, it would be most important evidence in the present discussion.

But one species of lizard is found on the Chatham Islands, which is very variable, but which I consider to belong to the species *Mocóa zelandica*; it is, however, larger, and shows some slight differences in the shape of its cephalic shields.

A ringed sea-snake, probably *Platurus scutatus* of Australia and Polynesia, is sometimes washed alive on to our coasts as far south as the mouth of the river Waikato, but it is not yet ascertained whether it is an inhabitant of our seas. A peculiar variety of *Pelamis bicolor*, which as yet has not been found in any other locality, has also been taken on our shores.

AMPHIBIANS.

The amphibious animals are worse represented even than the reptiles, one species of frog (*Liopelma Hochstetteri*) being the only member of the class. This frog has now been found in three distinct localities, all, however, in the province of Auckland: these are, the Cape Colville ranges from Coromandel to Puriri, the Huia on the north side of the Manukau harbour, and the mountains behind Opotiki in the Bay of Plenty. It belongs to a genus not found elsewhere; but its nearest ally is *Telmatobius peruvianus* from Peru, and it should be remembered that the frogs of Australia are also allied to South-American forms. It is evident that the absence of other Batrachians cannot be accounted for by the unsuitability of climate or want of food; for the common green frog of Australia (*Litoria aurea*), which has been introduced, has spread with great rapidity around both Auckland and Christchurch.

The evidence of the reptiles, therefore, is that New Zealand has had land communication with some of the Pacific islands at a later date than with Australia; for in the first case there is no specific difference between forms found in both places, while in the latter the species are now quite distinct. Our frog proves a connexion with South America at a period so remote that changes have since taken place of generic value.

[To be continued.]

VII.—*On the Development of the Polypes and of their Polypary.*
By M. H. de LACAZE-DUTHIERS.*

LAST summer the Academy requested the Minister of Marine to permit my embarkation on board the 'Narval,' which was then occupied in completing the hydrography of the Algerian coasts. My object in undertaking this voyage was to study again the coral banks, the richness of which I had previously ascertained in 1860, 1861, and 1862.

During the voyage I have had the opportunity of collecting observations, the results of which, indicated in short notes, do not seem to have been accepted in France. I have been able to verify afresh the facts which I am now going to publish in detail, and I think that I ought first of all to communicate these results to the Academy.

I refer now to the development of polyparies.

* Translated by W. S. Dallas, F.L.S., from the 'Comptes Rendus,' November 24, 1873, pp. 1201-1207.